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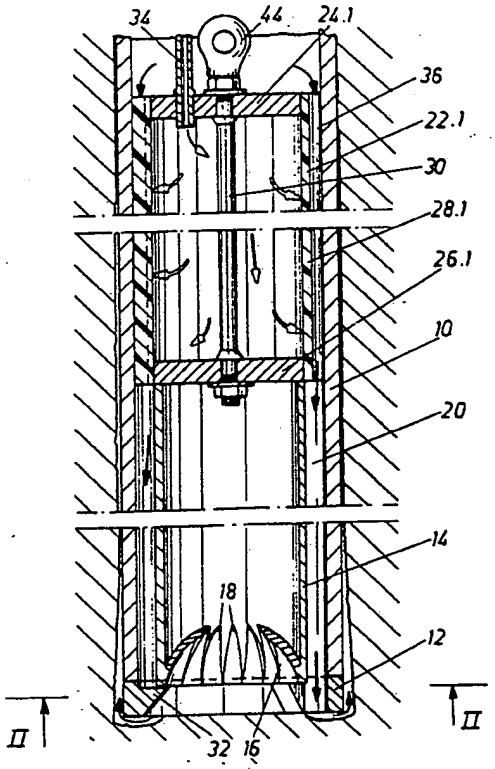
(57) Abstract

A device for geotechnical sampling. A core barrel (14) is intended to be applied to the lower end of a drill pipe (10) which is driven down into the ground with the aid of percussion and/or rotary drilling. The core barrel (14) is connected to an expandable sleeve (22). To retain the core barrel a positive pressure is generated inside the sleeve (22) to expand the walls thereof, whereby the walls will abut against the walls of the drill pipe (10). In this manner the sleeve (22) and the core barrel (14) are safely secured during the sampling operation. When the core barrel is filled, the pressure inside the sleeve (22) is reduced and the core barrel is pulled upwards through the drill pipe (10).



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A Device for Geotechnical or Geological Sampling

The subject invention is intended to be used in geotechnical or geological sampling during which a drill pipe is driven down into the ground. The drill pipe houses a core sampling barrel by means of which core samples are taken from the earth strata.

One problem encountered with prior-art geotechnical core sampling equipment is the provision of the core sampling barrel inside a drill pipe which is to be driven down into the ground through percussion drilling. During the driving-down operation the core catcher must be held captive in a position at the lower end of the drill pipe and this without weakening the latter.

When a drill pipe is driven down into the ground by means of rotary drilling the core catcher is provided in accordance with prior-art technology with a number of pawls which are arranged to engage in a groove on the internal face of the pipe. The pawls may be controlled from above ground and the arrangement allows the core barrel to be disengaged and pulled up to the ground while the drill pipe remains inside the borehole. The possibility of performing continuous core sampling at various levels without the necessity of withdrawing the drill pipe from the borehole after each sampling operation would be advantageous, since it is desirable to avoid that material which separates from the walls of the borehole fall to the bottom of the hole and is mixed with sampling materail taken at other levels.

The purpose of the subject invention is to provide a geological or geotechnical core sampler which allows a drill pipe to be driven into the ground by means of percussion and/or rotary drilling and to take core samples while the drill pipe still remains in position inside the borehole. These purposes are achieved in accordance with the invention by means of a sampler which is characterized therein that an expandable element is combined with the core sampling barrel, that means are provided for controlled generation of both an increased pressure and a lowered pressure in the expandable element, that the expandable element is arranged, in response to pressure increases, to abut against the wall of the drill pipe for frictional engagement therewith, that means are provided to remove the expandable element, said expandable element being a sleeve which comprises comparatively rigid top and bottom plates, that a spacer member is provided to keep said top and bottom plates in a fixed relative position, and in that the expandable element has resilient walls.

Further characteristics of the invention will appear from the appended claims.

The invention will be described in closer detail with reference to the accompanying drawings, wherein

Fig. 1 is a longitudinal sectional view along line I-I of Fig. 2 through the lower end of a drill pipe and the device in accordance with the invention with its associated core barrel.

Fig. 2 is a cross- sectional view along line II-II of Fig. 1 through the drill pipe and the device in accordance with the invention.

Figs. 3 and 4 are longitudinal and transverse sectional views similar to respectively Fig.1 and Fig. 2 and show an alternative embodiment of the invention. Figs. 1 and 3 are partly broken for the sake of clarity.

In geotechnical core sampling operations with the use of the device in accordance with the invention a drill pipe is driven down into the ground by means of percussion and/or rotary drilling. In the conventional manner the drill pipe 10 is provided with a hard metal lining 12 (hard metal prongs) at its lower end. (In rotary drilling the lining 12 may contain diamonds). Water or other suitable flushing medium is flushed through the pipe 10 in order to remove separated or crushed material below the drill pipe 10. The flushing medium is indicated by filled black arrows in the drawings.

A core sampler in the form of a core barrel 14 is positioned at the lower part of the drill pipe 10. The core barrel 14 has a core catcher 16 at its lower end. The core catcher may be formed with a number of prongs 16 which are bent upwards/inwards. A gap 20 is left between the walls of the core barrel 14 and the drill pipe 10 through which the flushing medium may flow. The core catcher retains the desired sample inside the core barrel 14 when the latter is being pulled upwards through the drill pipe 10.

In accordance with the invention an expandable element is provided inside the drill pipe. The expandable element is in the form of an elongate cylindrical sleeve (22 (22.1 in Fig. 1 and 22.2 in Fig 2). The sleeve comprises a plate-like lid 24 (24.1 and 24.2, respectively) and a bottom plate 26 (26.1 and 26.2, respectively) of a comparatively rigid material, such as metal. The sleeve has a cylindrical wall 28 (28.1 and 28.2, respectively) of a comparatively resilient material, such as rubber, plastics or an equivalent material. The lid 24 and the bottom 26 of the sleeve 22 are interconnected by a stay 30 keeping the bottom 26 and the lid 24 a constant distance apart.

To assemble the sampling equipment the core barrel 14 together with the sleeve 22 are inserted through the drill pipe 10 into abutment against stop shoulders 32 formed at the lower edges of the drill pipe. The lower edge of the core barrel 14 will be positioned at a higher level than and be protected by the hard metal lining 12. In order to retain the core barrel in this position, a positive pressure is generated inside the sleeve 22 to cause the sleeve wall 28 to expand into abutment against the internal wall of the drill pipe 10. The frictional engagement thus created retains the core barrel in the desired position while the drill pipe 10 is being driven into the ground and material is being collected inside the core barrel 14. When the individual sampling operation is completed and the core barrel is filled, the pressure inside the sleve 22 is reduced, allowing the sleeve 22 to be retracted from the drill pipe together with the core barrel 14 while the drill pipe remains in position inside the borehole. The core barrel 14 is emptied and is returned to its position at the lower end of the drill pipe 10 for further sampling operations.

The expandable sleeve 22 may be designed in various ways. In accordance with the embodiment illustrated in Fig. 1 a line 34 containing pressurized medium is connected to the sleeve 22.1. As indicated in Fig. 1 the pressurized medium may be air or another gas but also liquids could be used. Pressurized medium is supplied via the line 34 to the sleeve 22.1 to generate a positive pressure therein, and away from the sleeve 22.1 to reduce the pressure, allowing the sleeve 22.1 together with the core barrel 14 to be pulled out from the drill pipe 10.

In accordance with the embodiment shown in Figs. 1 and 2 the external wall 28.1 of the sleeve 22.1 has a corrugated cross-sectional configuration whereby channels 36 are formed in which the flushing medium may flow between the sleeve 22.1 and the internal wall of the drill pipe 10.

It is possible to generate a positiv pressure inside the sleeve 22 by equipping it before its insertion into the drill pipe 10 with a pressure cartridge, a pressure cylinder or the like. When the core catcher 14 reaches the desired position the pressure cartridge is activated (for instance by opening a valve) and a positive pressure is generated inside the sleeve 22. The pressure in the sleeve 22 is reduced after the sampling operation by means of a valve or similar means which is positioned in either one of the plates 24.1 or 26.1 and which may be remote-controlled.

A second embodiment of the invention is illustrated in Figs. 3 and 4. In accordance with this embodiment inlet apertures 38 are formed in the lid 24.2 through which the flushing medium is supplied to the interior of the sleeve 22.2. The bottom plate 26.2 of the sleeve 22.2 is formed with outlet apertures 40 for the flushing medium (which is indicated by filled arrows). The total flow area of the outlet apertures 40 is less than the flow area of the inlet apertures, whereby the pressure inside the sleeve 22.2 increases when flushing medium flows through the latter. The sleeve 22.2 thus is retained in the desired position inside the drill pipe 10. In accordance with this embodiment the flushing medium flows through the sleeve and the external wall thereof therefore need not have a corrugated configuration in order to form channels but could be smooth. The pressure inside the sleeve 22.2 is reduced by throttling or interruption of the flushing medium supply.

For the purpose of achieving improved retainment of the sleeve 22 inside the drill pipe the internal face thereof may be knurled 42 (see Fig. 3). The knurls do not weaken the drill pipe and may be used in all the described embodiments of the invention.

Figs. 1 and 3 show generally means 44 for operation of the sleeve 22 and the core catcher 14 associated therewith. These components preferably are manufactured in accordance with prior-art technique.

As should be apparent from the aforegoing description the design of the device in accordance with the invention is instrumental in securely retaining the core barrel 14 inside the drill pipe 10 while the latter is being driven down into the ground by means of the percussion and/or rotary drilling technique. The resilient retainment of the barrel 14 results in a bond which is more resistant to impacts than are rigid mechanical bonds and which therefore is more suitable for use in percussion drilling techniques.

The embodiments of the invention are to be regarded as examples only and a number of modifications are possible within the scope of the appended claims. The choice of flushing and pressurized mediums could be made in dependence on the circumstances and prevailing conditions.

CLAIMS

1. A device for geotechnical sampling intended to be mounted on a drill pipe (10) and comprising a core sampling barrel (14), c h a r a c t e r i z e d therein that an expandable element (22) is combined with the core barrel (14), that means are provided for controlled generation of both an increased pressure and a lowered pressure inside the expandable element (22), that the expandable element (22) is arranged, in response to pressure increases, to abut against the wall of the drill pipe (10) for frictional engagement therewith, that means (44) are provided to remove the expandable element, said expandable element being a sleeve (22) which comprises comparatively rigid top and bottom plates (24 and 26, respectively), that a spacer memeber (30) is provided to keep said top and bottom plates in a fixed relative position, and in that the expandable element has resilient walls (28).

2. A device as claimed in claim 1, c h a r a c t e r i z e d therein that the resilient wall (28.1) of the expandable element (22.1) has a corrugated external surface, whereby channels (36) are formed adjacent the pipe wall for through-flow of a flushing medium.

3. A device as claimed in any one of the preceding claims, c h a r a c t e r i z e d therein that inlet openings (38) are formed in the lid plate (24.2) of the expandable element (22) for supplying flushing medium and that outlet openings (40) are formed in the bottom plate (26.2) of said element (22), and that the total flow area of the outlet openings (40) is smaller than the total flow area of the inlet openings (38).

4. A device as claimed in any one of claim 1 or 2, c h a r a c t e r i z e d therein that a separate line (34) for supply of pressurized medium is connected to the expandable element (22.1).

5. A device as claimed in any one of claim 1 or 2, c h a r a c - t e r i z e d therein that the expandable element is equipped with a pressure cartridge, and that means are provided to release said pressure cartridge for the purpose of generating a positive pressure inside the expandable element.

Fig.1

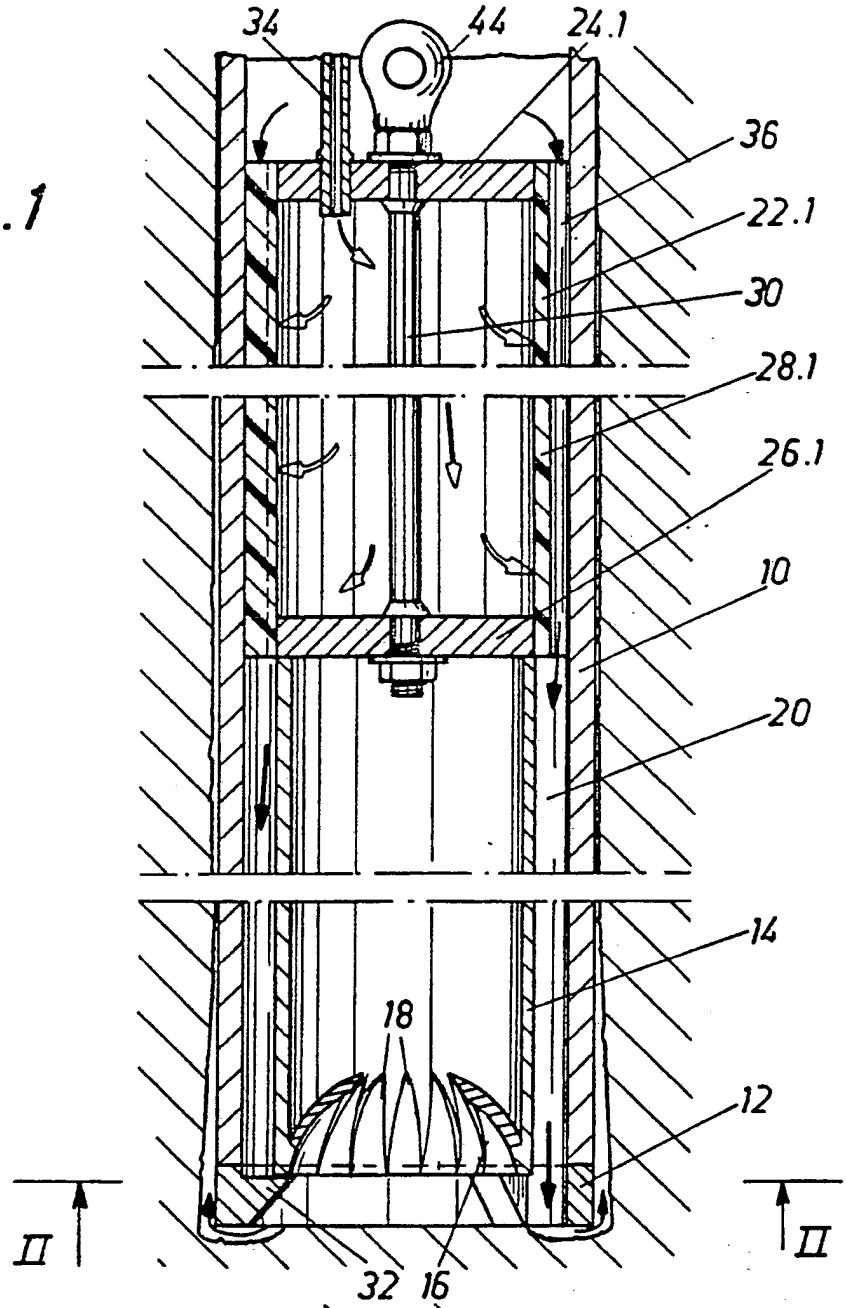

34
44
24.1
36
22.1
30
28.1
26.1
10
20
14
18
12
II
II
32
16

Fig.2

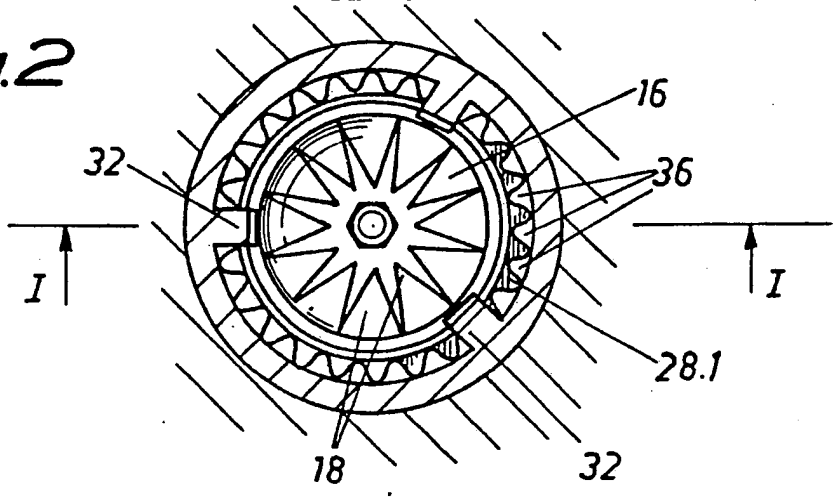

16
32
36
I
I
28.1
18
32

Fig.3

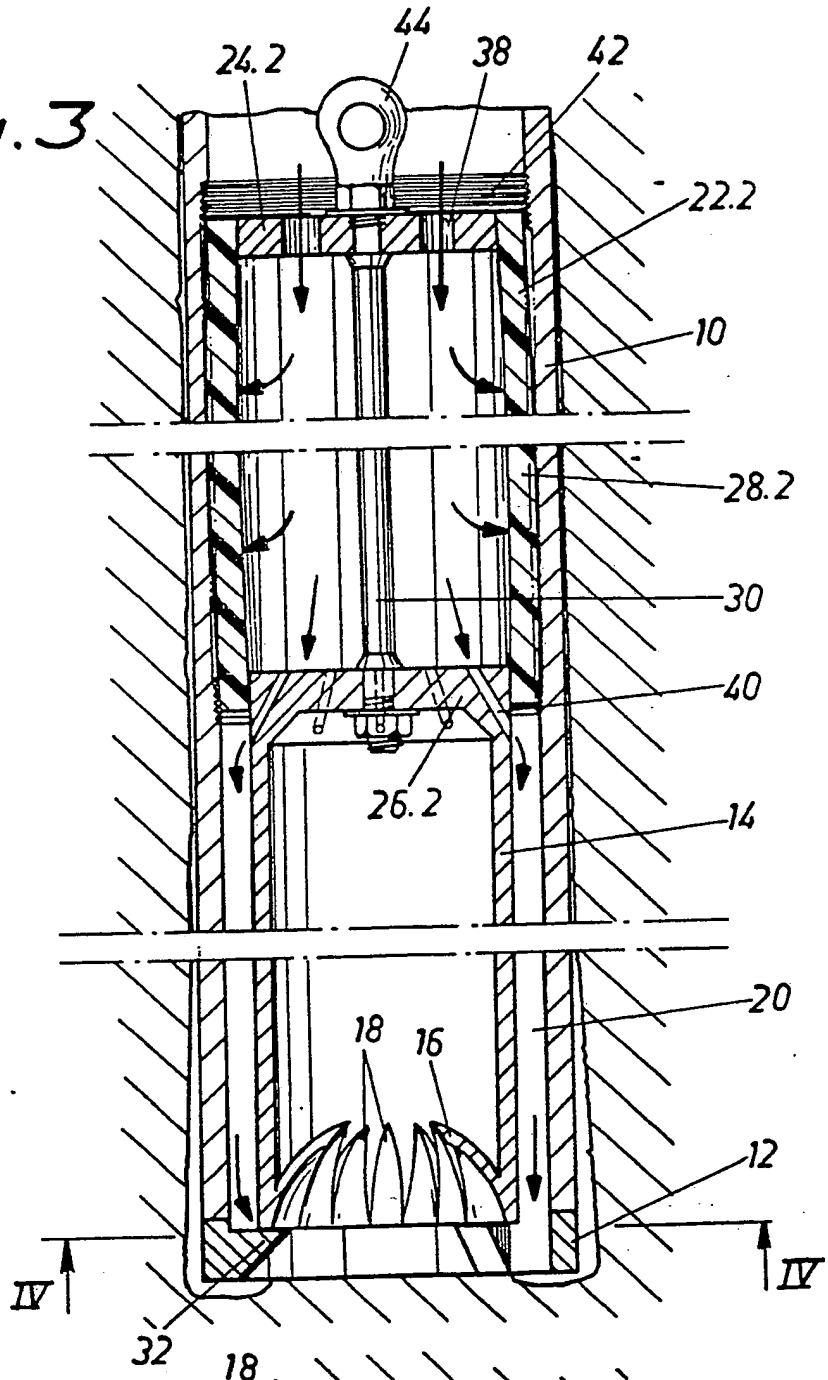
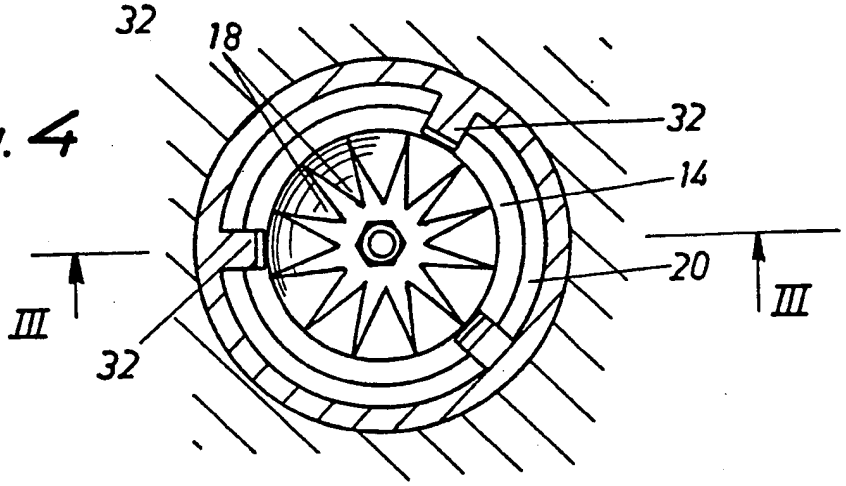

44
24.2
38
42
22.2
10
28.2
30
40
26.2
14
20
18
16
12
IV
IV
32

Fig.4


18
32
14
20
III
III
32

INTERNATIONAL SEARCH REPORT

International Application No PCT/SE87/00275

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) [6]

According to International Patent Classification (IPC) or to both National Classification and IPC 4

E 21 B 25/02

II. FIELDS SEARCHED

Minimum Documentation Searched [7]

Classification System	Classification Symbols
IPC 4	E 21 B 25/00, /02, /06, 49/00, /02; G 01 N 1/02-/08; E 02 D 1/00, /02, /04
US Cl	175: 58, 239, 240, 243-255, 308, 309

Documentation Searched other than Minimum Documentation to the Extent that such Documents are included in the Fields Searched [8]

SE, NO, DK, FI classes as above

III. DOCUMENTS CONSIDERED TO BE RELEVANT [9]

Category [10]	Citation of Document, [11] with indication, where appropriate, of the relevant passages [12]	Relevant to Claim No. [13]
A	SE, B, 397 561 (DRESSER IND. PROD. LTD) 8 December 1972	
A	US, A, 4 014 393 (HENSEL, Jr) 29 March 1977	

* Special categories of cited documents: [10]

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IV. CERTIFICATION

Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report
1988-01-08	1988 -01- 14
International Searching Authority	**Signature of Authorized Officer**
Swedish Patent Office	Christer Bäcknert

Form PCT/ISA/210 (second sheet) (January 1985)

Jan. 10, 1928. 1,655,644

R. C. BAKER

CORE RETAINER FOR CORE BARRELS

Filed Nov. 22, 1926

Fig. 1.

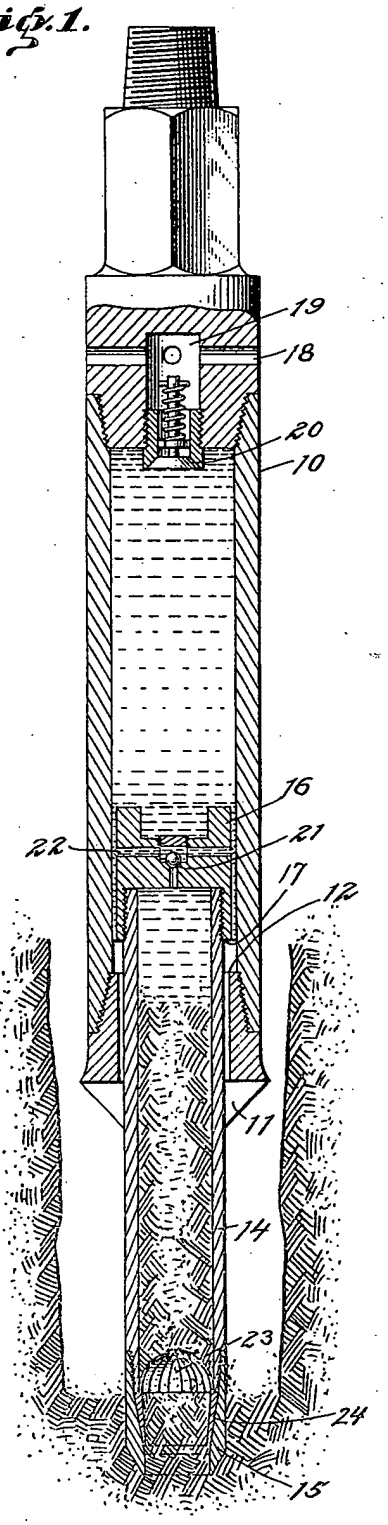


Fig. 2.

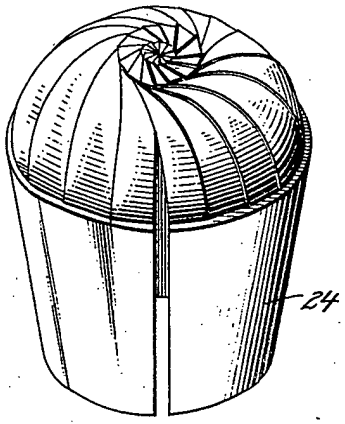
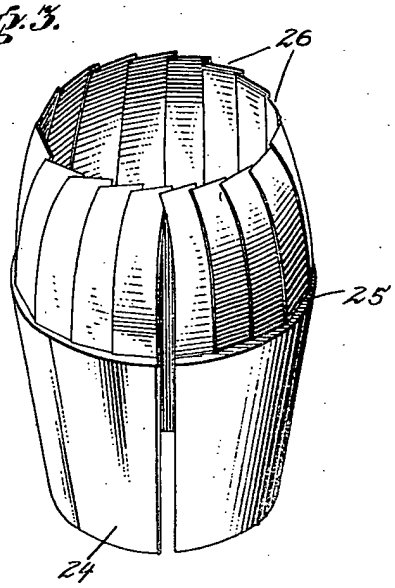


Fig. 3.



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